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MICROWAVE OVEN

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MICROWAVE OVEN

[Denshi renji]

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[There are no amendments to this patent.]

Claims

1. In a microwave oven that is provided with a heating chamber in which microwaves from a magnetron are radiated through a waveguide, a turntable is furnished for placing food to be able to rotate it in the heating chamber and a drive means that rotates the turntable, and that heats the food that rotates on the turntable with the microwaves,

a microwave oven characterized in that a vibration means is provided that can temporarily produce vibrations in the aforementioned rotating turntable during the heating operation.

2. In a microwave oven that is provided with a heating chamber in which microwaves from a magnetron are radiated through a waveguide, a turntable is furnished for placing food to be able

to rotate it in the heating chamber and a drive means that rotates the turntable, and that heats the food that rotates on the turntable with the microwaves,

a microwave oven characterized in that a control means is furnished for controlling the aforementioned drive means so that it will rotate the aforementioned turntable; that is, rotating forward during the heating operation, then forward and backward for a preset time to produce vibration.

3. The microwave oven mentioned in Claim 2 characterized in that the time the aforementioned turntable is rotated forward and backward is set to just before completion of the heating operation.

4. A microwave oven characterized in that it is provided with: a heating chamber in which microwaves from a magnetron are radiated through a waveguide,

a turntable furnished for placing food in the aforementioned heating chamber that can turn forward and backward,

a drive motor that can run forward and backward to drive the aforementioned turntable to turn forward and backward,

an input means that is operated according to the type of food to be heated,

a decision means that decides whether the heated food is a liquid food according to the information input from the aforementioned input means,

and a control means that controls the aforementioned drive means so that the aforementioned turntable that is turning forward during the heating operation is then turned forward and backward for a preset time to cause vibration if the aforementioned heated food is a liquid food.

Detailed explanation of the invention

[0001]

Industrial application field

This invention relates to a microwave oven that heats food with microwaves output from a magnetron while rotating it when placed on a turntable furnished in the heating chamber.

[0002]

Prior art

In microwave ovens that are widely popular today, various designs have been implemented to prevent uneven heating of the heated item and improve heating performance. An example shown in the microwave oven in Kokai Patent Application No. Hei 6[1994]-140148, is to provide a metal plate to agitate the electric waves in the waveguide that directs microwaves from the part that radiates the electric waves to the heating chamber. Optimal electric wave matching is obtained

by changing the shape and speed of rotation of the metal plate according to the heated item to make the electrical field intensity in the heating chamber uniform.

[0003]

The most popular method is to rotate the food itself by rotating the turntable, which is a food platter, and prevent uneven heating by making the microwaves strike the food uniformly.

[0004]

Problems to be solved by the invention

A certain level of improvement in uneven heating is achieved with a method that increases uniformity of the electric wave intensity and uniform irradiation by the microwaves in this way, but even with these methods, the way in which the microwaves irradiate the food changes slightly due to the effect of the shape of the microwave feed opening or the shape of the heating chamber cavity. A significant variation in electrical field distribution in the heating chamber occurs, and the food often heats unevenly because of it.

[0005]

Generally, when food in a solid form, such as rice, is heated, the method described above is effective. But for heating food in liquid form, such as sake or milk, variation remains from top to bottom, which means that uneven heating has not been completely controlled.

[0006]

This invention was created in consideration of the problems described above. Its purpose is to provide a microwave oven wherein with an apparatus that vibrates the turntable for an appropriate period of time while it is rotating, or by turning the turntable forward and backward so that vibration can be produced in the turntable, in addition to the conventional method of uniform heating by turntable rotation, minute vibration is added when the heated item is in a liquid form, such as sake or milk. This causes a convection phenomenon, by which variation from top to bottom, etc., can be kept to a minimum just with microwave heating and without which a uniform temperature increase would not have been obtained, and heating performance can be improved.

[0007]

Means to solve the problems

This invention is a microwave oven in which, in a microwave oven that is provided with a heating chamber in which microwaves from a magnetron are radiated through a waveguide, a turntable is furnished for placing food to be able to rotate it in the heating chamber and a drive

means that rotates the turntable, and that heats the food that rotates on the turntable with the microwaves, there is provided a vibration means that can temporarily produce vibrations in the aforementioned rotating turntable during the heating operation.

[0008]

This invention is also a microwave oven in which, in a microwave oven that is provided with a heating chamber in which microwaves from a magnetron are radiated through a waveguide, a turntable is furnished for placing food to be able to rotate it in the heating chamber and a drive means that rotates the turntable, and that heats the food that rotates on the turntable with the microwaves, a control means is furnished for controlling the aforementioned drive means so that it will rotate the aforementioned turntable; that is, rotating forward during the heating operation, then forward and backward for a preset time to produce vibration.

[0009]

This invention is also a microwave oven in which the time the aforementioned turntable is turned forward and backward is set to just before completion of the heating operation.

[0010]

In addition, this invention is a microwave oven that is provided with: a heating chamber in which microwaves from a magnetron are radiated through a waveguide; a turntable furnished for placing food in the aforementioned heating chamber to be able to turn it forward and backward; a drive motor that can run forward and backward to drive the aforementioned turntable to turn forward and backward; an input means that is operated according to the type of food to be heated; a decision means that decides whether the heated food is a liquid food according to the information from the aforementioned input means; and a control means that drives the aforementioned drive motor to run forward and backward to turn the aforementioned turntable, which is rotating forward during the heating operation, to go forward and backward for a preset time to produce vibration if the aforementioned heated food is a liquid food.

[0011]

Operation

When heating starts, the turntable rotates forward, and the food to be heated is irradiated with microwaves, the vibration means operates for a certain time during the heating operation and the turntable vibrates. Because of this, the contents of the heated article in liquid form, such as sake or milk, is shaken, the convection phenomenon increases, and uneven heating from top to bottom can be reduced.

[0012]

When heating starts, the turntable rotates forward, and the food to be heated is irradiated with microwaves by the turntable's turning forward and backward for a set time during the heating operation, vibration in the turntable occurs, minute vibration is applied to the heated item in liquid form, such as sake or milk, on the turntable, and a convection phenomenon is produced so that temperature variation from top to bottom is curtailed as much as possible.

[0013]

When the turntable is turned forward and backward just before completion of the heating operation, the liquid is heated to a certain temperature and vibration is added while convection is produced, the convection effect is further increased, and the elimination of uneven heating will be remarkable.

[0014]

If it is decided that [the food] is a liquid from the food information from the input means, the microwave oven automatically turns the turntable forward and backward for a certain time and vibrates the turntable. The liquid food will be easily and satisfactorily heated and prepared with no uneven heating.

[0015]

Embodiment of the invention

An embodiment of this invention will be explained below based on the figures.

[0016]

In Figure 1, which shows the schematic constitution of the microwave oven, (1) is the heating chamber (cavity) formed inside the microwave oven unit that accommodates and heats the heated item, such as food. A square waveguide (2) is connected to the top surface of heating chamber (1), and waveguide (2) and heating chamber (1) contact through opening (3) for microwave feeding formed in the top surface of heating chamber (1). Magnetron (4) that generates microwaves is furnished on the opposite side of waveguide (2) and microwave discharge antenna (5) of magnetron (4) is also furnished to project into waveguide (2). Thus, microwaves discharged from antenna (5) by the oscillation of magnetron (4) pass through opening (3) through waveguide (2) and irradiate and heat food (6) in heating chamber (1).

[0017]

Turntable (7), which is a platter on which food (6) is placed, is provided to rotate in aforementioned heating chamber (1). With this application example, a case where sake is heated is shown. So (8) is a drive motor that rotates turntable (7). A geared motor or the like is used, and motor (8) is also able to turn forward and backward. For this reason, the turntable can be rotated forward and backward where the forward turning direction of normal rotation is indicated by the solid line arrow shown in Figure 2 and the backward turning direction is indicated by the dotted line arrow in the opposite direction.

[0018]

Automatic cooking menu buttons are operated according to the food (6) to be heated or the heating time and temperature for various foods is selected with a setting knob on an operating panel provided on the front of the microwave oven unit. Heating is started by operating a start button, and food (6) is irradiated with microwaves from magnetron (4) and heated for the set heating time. The operation is performed such that turntable (7) is also rotated simultaneously in the forward turning direction by drive motor (8) during the heating operation and stops with completion of the heating operation time, for normal food heating.

[0019]

When the heated item is a liquid food (6), such as milk or sake, the rotation of turntable (7) alternates forward and backward with a small amplitude for a certain time during the heating operation, the liquid inside is vibrated, convection of the liquid is promoted, and uneven heating from top to bottom of the liquid will be eliminated.

[0020]

It is also desirable that the time period for which turntable (7) is turned forward and backward and that is believed to be effective in eliminating uneven heating of the liquid from top to bottom be set in this case for a certain time prior to completion of the heating operation. This is because as heating progresses and the liquid inside becomes quite warm near the completion time, the convection phenomenon has also started. If vibration of the turntable is applied in this state, the convection will become even more thorough and effective in eliminating uneven heating of the liquid from top to bottom.

[0021]

Of course, it could also be set to be carried out once or many times for any fixed period during the heating operation, rather than at a time prior to completion.

[0022]

Control will be explained next. In Figure 3, (9) is an input means realized as a keyboard furnished on the operating panel corresponding to the automatic cooking menu buttons or setting knobs, heating start buttons, etc. described above for inputting information to control (10) about the food to be heated, the heating time, the heating temperature, and instructional information, such as start heating. Control part (10) includes a microcomputer which performs total control of the overall heating operation, such as controlling oscillation and stopping of magnetron (4) and controlling the driving of turntable (7).

[0023]

Forward drive circuit (11) for forward turning of drive motor (8) of turntable (7) and reverse drive circuit (12) for backward turning of drive motor (8) are each connected to control part (10). Forward drive circuit (11) and reverse drive circuit (12) are operated based on forward and backward turn signals output from control part (10) to turn turntable (7) forward and backward.

[0024]

(13) is a timer for measuring the heating operation time. When the set heating operation time is timed by timer (13), a completion signal is input to control part (10) and control part (10) will output a stop signal to stop the rotation of turntable (7).

[0025]

In addition, when food (6) that is heated is a liquid food (6), such as sake or milk, control part (10) will make a decision as to whether heated food (6) is a liquid food based on the information input from the keyboard so that turntable (7) will be turned forward and backward. Control part (10) has a decision means for this purpose.

[0026]

Figure 4 shows the control flow by which aforementioned turntable (7) is turned forward and backward during the heating operation.

[0027]

When a heating operation start signal is input to control part (10) from keyboard (9), the control flow starts and whether the heating operation has started is decided (decision 15). If decision 15 is yes by looking at the output of a heating operation start signal or the like, processing

is executed so that a forward turn signal is output from control part (10) to forward drive circuit (11) and turntable (7) is turned forward (process 16). At this time, if there is no heating operation start signal and operation has not started, the decision will be no. Processing is executed that keeps turntable (7) stopped (process 21) and the flow is ended.

[0028]

During execution of process (16) during which turntable (7) turns forward and the heating operation is carried out based on set time (T), it is decided whether the heating operation has progressed for a predetermined fixed time (T_0) within set time (T) and has reached the time just prior to completion of the operation (decision (17). Decision (17) is made by looking at whether there is a signal output at the time when fixed time (T_0) has elapsed by timer (13) which is measuring the heating operation time. When a signal is output and prior to completion, where decision 17 will be yes, the decision is made whether food (6) is liquid (decision 18). On the other hand, while prior to completion, where decision 17 is no and no signal is output, processing returns to 16 and turntable (7) continues to be turned forward.

[0029]

At the time prior to completion of operation is reached and going to decision (18), whether it is a liquid food (6) is decided from the food information produced by whether say, the automatic cooking button for milk or sake was pressed. When it is liquid food (6) and decision 18 is yes, process 19 is executed.

[0030]

In process 19, drive signals are output alternately to forward drive circuit (11) and reverse drive circuit (12) at low frequency for a certain fixed time period from the output port of control part (10). Forward drive circuit (11) and reverse drive circuit (12) are operated alternately and drive motor (8) of turntable (7) is driven to turn forward and backward for a fixed period, thus performing an operation to move turntable (7) forward and backward very slightly. In this way heating occurs while turntable (7) is turned forward and backward.

[0031]

Heating operation while turntable (7) is turned forward and backward is controlled based on the decision whether the next preset heating operation time (T) has elapsed and the operation is completed (decision (20). If decision 20 is no (heating operation time (T) has not elapsed), process (19) for forward and backward operation is continued. That is, the heating operation while

turntable (7) is turned forward and backward will be performed during the time remaining of the preset heating time (T).

[0032]

When heating operation time (T) has elapsed and decision 20 is yes, output of drive signals from control part (10) will stop, processing to stop turntable (7) (process 21) is executed, and processing is complete.

[0033]

By adding process 19 in this way, forward and backward minute vibration can be imparted to turntable (7) as shown in Figure 2, and it will be possible to generate a strong convection phenomenon with liquid food (6), such as sake or milk, to curtail uneven heating, such as variation from top to bottom, as much as possible, particularly with liquid food (6), which could not have been eliminated by rotation alone of a conventional turntable (7).

[0034]

In this connection if there is no liquid food, which will be no at decision 18 described above, turntable (7) continues to turn forward, [processing] goes to decision 22 for whether the next heating time (T) has elapsed to reach completion of the operation. Normal heating is carried out so that when heating time (T) elapses, the operation is completed.

[0035]

With this application example, forward and backward turning of turntable (7) is done by a decision (decision 18) whether information for liquid food (6) was input to control part (10). Decision 18 could also be made according to whether there is a signal from an operating button that is pressed when forward and backward turning of turntable (7) is desired.

[0036]

With the aforementioned application example, turntable (7) is vibrated by turning forward and backward. As shown in Figure 1, an ultrasound generator (25) can also be furnished under turntable (7) as the vibration means and ultrasound generator (25) can be controlled by the microcomputer to operate for an appropriate set time period after operation starts to vibrate turntable (7).

[0037]

Effects of the invention

With this invention, as above, while the turntable is rotated by the drive motor and heating occurs, the turntable will be vibrated by a vibration means for an appropriate period of time. So when the food on the turntable is liquid, convection in the liquid can be promoted and uneven heating reduced.

[0038]

Also, by making it possible to run the drive motor forward and backward and perform a minute forward and backward movement of the turntable for a certain time during the heating operation, when the turntable is normally rotated in a fixed direction by the drive motor, minute vibration is applied to the food on the turntable, which is useful for generating a convection phenomenon. Heating performance can be improved; specifically, a uniform temperature rise that would not have been obtained just with microwave heating and normal turntable rotation, which has a significant effect on improving such uneven heating as variation from top to bottom; in particular, for liquid foods such as sake or milk.

[0039]

Also, when the period of time when the turntable is turned forward and backward is before completion of the heating operation and performed last in the operation, the liquid convection effect can be increased and uneven heating curtailed even more.

[0040]

Because [the invention] is constituted so that forward and backward turning by the turntable is automatically carried out when it is decided that the food is a liquid from the information input to the control part from the keyboard, a microwave oven can be provided that makes convenient and easy heating and cooking possible where uneven heating of liquid products is reliably eliminated.

Brief description of the figures

Figure 1

A front structure view of the heating chamber of a microwave oven that pertains to this invention.

Figure 2

A plane view that shows what the turntable is like that turns forward and backward.

Figure 3

A block circuit diagram of the controller that turns the turntable forward and backward.

Figure 4

A control flowchart for turning the turntable forward and backward.

[Explanation of symbols]

(1) Heating chamber
(4) Magnetron
(6) Food
(7) Turntable
(8) Drive motor
(10) Control part
(11) Forward drive circuit
(12) Reverse drive circuit
(13) Timer
(25) Ultrasound generator

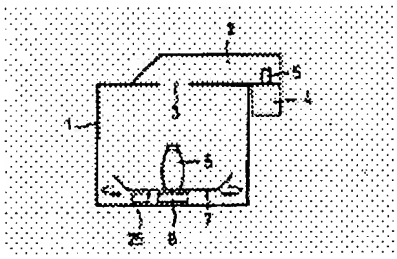

Figure 1

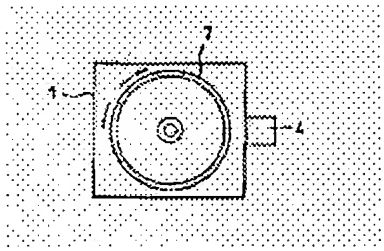

Figure 2

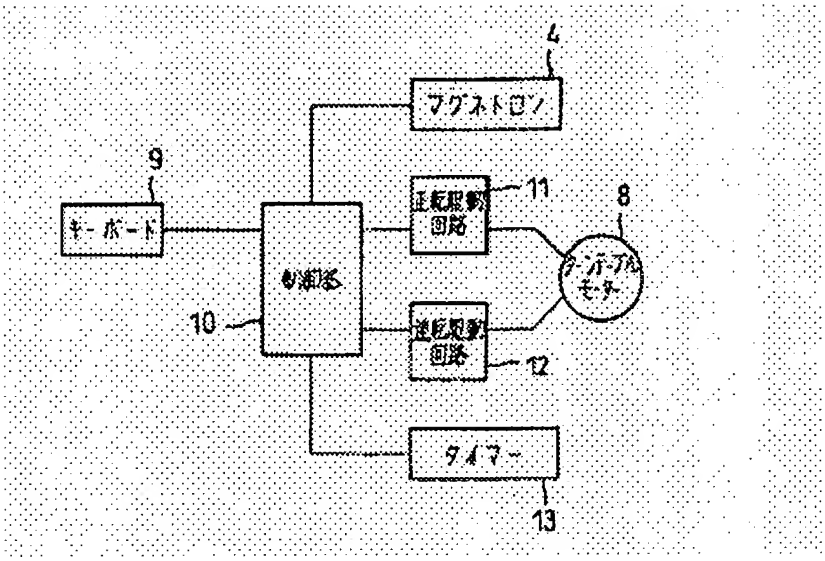

Figure 3

Key:
4	Magnetron
8	Turntable motor
9	Keyboard
10	Control part
11	Forward drive circuit
12	Reverse drive circuit
13	Timer

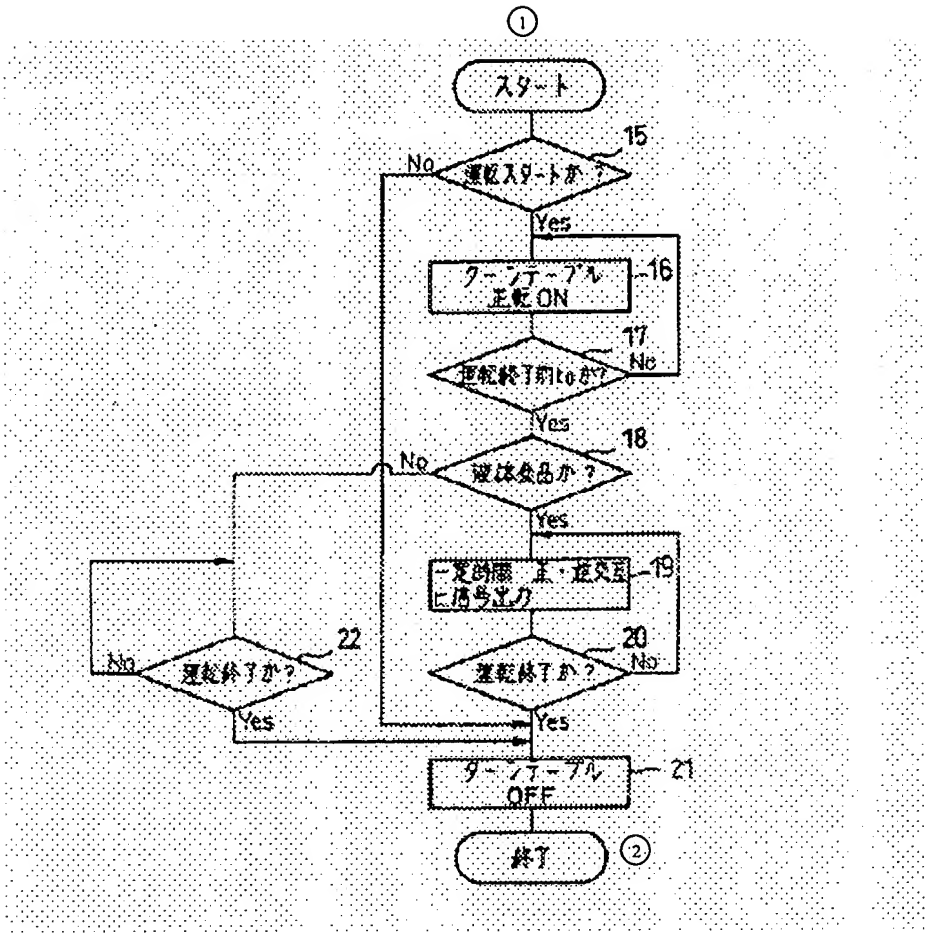

Figure 4

Key:
1 Start
2 End
15 Operation start[ed]?
16 Turntable forward turning on
17 Prior to completion of operation?
18 Liquid food?
19 Signals output for forward/backward, or a fixed time?
20 Operation complete?
21 Turntable off
22 Operation complete?